MA 2121 - Differential Equations
Prerequisite Skills

Prerequisite Courses: MA 1118 or equivalent
MA 1042 (may be taken concurrently)

In addition to the general coursework indicated above, the student wishing to take this course should possess the following specific prerequisite skills - be able to:

1. Calculus:

a. State a definition of *limit*, and be able to compute the limits of given expressions involving one or more independent variables.

b. Give and use geometrical interpretations of the ordinary and partial derivative, and of single and multiple integrals.

c. Find, from memory, ordinary or partial derivatives of elementary functions such as sines, cosines, natural logarithms, exponentials, and polynomials.

d. Find, using the sum, quotient, product, and chain rules, ordinary and partial derivatives of combinations or compositions of elementary functions.

e. Sketch the general shape, to include approximate maxima and minima, regions of increase and decrease, and zeros (axis crossings) of a given function of a single variable, especially simple functions such as (piecewise) trigonometric, exponential, polynomial and logarithmic functions.

f. Sketch the general shape of appropriate functions of two independent variables, and describe and sketch the level curves of such functions.

g. Find, from memory and using substitution, change of variables, the addition properties of the integral, or integration by parts, as appropriate, the antiderivatives of given combinations/compositions of elementary functions.

h. Use partial fractions to find the antiderivative of a given rational function.

i. Given a particular (piecewise) function, specified either analytically of graphically, calculate the definite integral of that function between specified limits.

j. Calculate improper integrals, especially when the domain of integration is semi-infinite or infinite.

k. Compute derivatives of definite integrals when the variable to be differentiated appears in either the limits or the integrand, or both.

l. State a definition of *convergence*, and find the limit (if any exists) of a given appropriate infinite sequence or series.

m. Use the ratio, comparison or p-tests, as appropriate, to determine whether a given infinite series converges.

n. Find the Taylor Series expansion of a given function, and determine its radius of convergence.

2. Linear Algebra:

a. Use matrix/vector notation to express the elements of a matrix, and to denote matrix sums, matrix products, systems of linear equations, etc.

b. State the definitions of linear independence, dimension, span and basis, and, given a specific set of vectors in R^n, determine whether they are linearly independent and whether they form a basis for R^n.

c. Solve by hand, using Gaussian elimination, a given system of up to four linear equations in four unknowns, and determine whether a unique solution exists.

d. Calculate by hand the determinant of a given system matrix of size up to four by four, and and use determinants to solve given systems of linear equations by Cramer's rule.

e. Find by hand, the inverse of a given nonsingular matrix of size up to four by four.

f. Find by hand, the eigenvalues and eigenvectors of a given matrix of size up to four by four.

3. Complex Algebra:

a. Convert a given complex number between real/imaginary part form and polar form.

b. Add, subtract, multiply and divide complex numbers.

Suggested References

Calculus - *Calculus*, by Finney and Thomas

Chapters 1-10, 13

Linear Algebra - *An Introduction to Matrix Algebra*, NPS notes (available from Mathematics Dep't)

Sections 1-5, 9-12

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